



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Satellite navigation systems

Course

Field of study

Electronics and Telecommunications

Area of study (specialization)

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

I/II

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

Number of hours

Lecture

30

Laboratory classes

0

Other (e.g. online)

Tutorials

0

Projects/seminars

0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

prof. dr hab. inż. Andrzej Dobrogowski

andrzej.dobrogowski@put.poznan.pl

Responsible for the course/lecturer:

Prerequisites

Student has a systematic knowledge of mathematical analysis, algebra, theory of probability, physics, and the theory of EM field, EM waves propagation, and of construction and properties of antennae. He has a detailed, systematic knowledge of the fundamentals of circuit theory and signal theory. Student knows the principle of operation of digital transmission systems. He Has a detailed, systematic knowledge, of the fundamentals of the telecommunication theory.

Course objective

Recognition and understanding of the principles of operation of the satellite navigation systems and their augmentation systems.

Course-related learning outcomes

Knowledge

Student after passing this course:



1. has a systematic knowledge, with necessary mathematical background, of satellite navigation systems;
2. understands basic concepts of global navigation satellite systems. Is able to justify practical implementation of these concepts;
3. may motivate the needs that navigation satellite constellation must fulfill;
4. understands the limitation of the satellite navigation systems and the necessity of using complete systems in order to get everywhere available navigation.

Skills

Student:

1. is able to evaluate the parameters of telecommunication satellite systems; is able to evaluate the parameters which determine the positioning accuracy of a satellite navigation system; is able to measure the parameters of signals and components of satellite navigation systems;
2. is prepared to use technical literature (also technical periodicals);
3. effectively use satellite navigation equipment;
4. is able to make course estimation of the GNSS receivers quality.

Social competences

Student:

1. stresses the importance of navigation abilities for society;
2. is able to recognize a problem whose effective solution involves the GNSS.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge is verified by a written test at the end of the semester. The test contains 3-6 problem questions evaluated using points. Passing threshold: 50% of total points (it may change depending on the difficulty of the questions, how they are scored etc.). Activity and demonstration of knowledge during the lecture allow to get additional points for final assessment.

Programme content

Ubiquitous positioning and navigation. Navigation methods. Basic characteristics of the navigation systems. Time scales - GNSS system time. Coordinate systems and reference frames. Models of the Earth. World geodetic system WGS-84. Kepler's laws. Equation of satellite motion, satellite orbits. Keplerian elements (parameters). Navigation satellite constellation. Orbital ephemerides. GNSS signals and modulation schemes. Navigation message and its content. Navigation equations and their solving methods. GNSS user's velocity determination. Relativistic effects. GNSS navigation performance. PVT



services. Architecture of GNSS receivers. GPS, GLONASS, Galileo and Compass. Differential and augmentation systems: DGPS, WASS, EGNOS, SBAS, GBAS, and ABAS. Examples of GNSS application.

Teaching methods

Lecture: multimedia presentations illustrated with examples and mathematical or graphic descriptions presented on the board.

Bibliography

Basic

1. J. Narkiewicz, GPS i inne satelitarne systemy nawigacyjne, WKiŁ, Warszawa 2007
2. J. Januszewski, Systemy satelitarne GPS, Galileo i inne, Wydawnictwo Naukowe PWN, Warszawa 2006
3. C. Specht, System GPS, Wydawnictwo BERNARDINUM, Pelplin 2007
4. A. Dobrogowski, Sygnał czasu, Wydawnictwo Politechniki Poznańskiej, Poznań 2003

Additional

1. S. Gleason, D. Gebre-Egziabher (editors), GNSS Applications and Methods, Artech House, Boston London 2009
2. P. Misra, P. Edge, Global Positioning System. Signals, Measurements, and Performance, Revised Second Edition, Ganga-Jamuna Press, 2011
3. B. Hofmann-Wellenhof, H. Lichtenegger, E. Wasle, GNSS: Global Navigation Satellite Systems GPS, GLONASS, Galileo and more, Springer Wien New York 2008
4. R. Prasad, M. Ruggieri, Applied Satellite Navigation Using GPS, GALILEO, and Augmentation Systems, Artech House, Boston London 2005

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	40	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) ¹	10	0,0

¹ delete or add other activities as appropriate