COURSE DESCRIPTION
POSITIONING AND LOCATION-BASED SERVICES

SSD: TOPOGRAFIA E CARTOGRAFIA (ICAR/06)

DEGREE PROGRAMME: TRANSPORTATION ENGINEERING AND MOBILITY (P55)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
CHANNEL: FG A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 9

REQUIRED PRELIMINARY COURSES

None

PREREQUISITES

Knowledge of Mathematics, Physics, Statistics, and Computer Science at Bachelor's level are required. A general basis on terrestrial surveying techniques is useful.

LEARNING GOALS

The course aims to illustrate the key characteristics of positioning and location based services providing students with knowledge related to the positioning techniques in different scenarios. The lectures will focus on real time navigation measurements, applied to mobile positioning and location based-services. All the geospatial applications in which location, proximity, and connectivity are the organizing principles will be studied.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

Students must demonstrate that have learned the fundamental notions regarding: measurements and methods for geodetic positioning; concepts and description of satellite positioning and navigation systems; inertial navigation; outdoor and indoor applications; location-based service technologies and issues.

Applying knowledge and understanding

By applying the acquired skills, students must be able to collect, process, analyze and utilize information in the area of positioning and location-based services.

COURSE CONTENT/SYLLABUS

Topics of course lectures include:

1. Referencing a position and geodetic data processing, including methods of collection, measurement, computation, analysis, and modeling of geodetic data, particularly in the form of mapping surveys.
2. Representing, organizing, and searching spatial data and object location. Maps and GIS in location based services.
3. Fundamentals of positioning. Classification of positioning techniques. Basic positioning methods.
4. Satellite navigation. GNSS systems, observations and characteristics of instrumentation. GNSS error sources and biases. Mathematical models for absolute and differential static and kinematic positioning. Kalman filtering applied to kinematic positioning. Ambiguity resolution procedures. GNSS augmentation methods.
5. Indoor positioning. Assisted, hybrid, and short range positioning and navigation: measuring approaches, principles, and technologies. Sensors for ubiquitous navigation and inertial navigation.
6. Mobile positioning and general aspects of location based services: classification, components and type of services.

READINGS/BIBLIOGRAPHY

E. Kaplan, C. Hegarty (2017). Understanding GPS/GNSS: Principles and Applications. Artech House Publishers.

J. Schiller, A. Voisard. (2004). Location-Based Services. Elsevier.

Supplementary teaching materials will be provided during the course.

TEACHING METHODS OF THE COURSE (OR MODULE)

The course is divided into lectures, classroom exercises with the use of calculation tools, and field operations with the use of instruments to deal with the applied knowledge.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

☐ Written

- [x] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [ ] Multiple choice answers
- [ ] Open answers
- [ ] Numerical exercises

b) Evaluation pattern

The exam aims to verify the level of achievement of the previously indicated training objectives. The theoretical and applicative contents covered during the course will be discussed during the oral exam, with the aim of evaluating the understanding of the basic principles and the ability to connect and compare different topics. This test also includes the presentation and discussion of the activities carried out during the laboratory.