



## Course Specification Document

<b>Title</b>	Positioning and Navigation Systems
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<b>Credits</b>	2.5 ECTS
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<b>Aims</b>	This course aims to provide the student with knowledge related to positioning and navigation systems, with emphasis on inertial navigation systems INS, global positioning system GPS and integrated INS/GPS navigation systems.
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### Intended learning outcomes

On successful completion of this course, the student will be able to:

- Define positioning and navigation systems.
- Describe inertial sensors and their characteristics.
- Formulate inertial and integrated navigation algorithms.
- Apply theoretical concepts in the field of navigation to real systems.
- Collect and process signals from inertial sensors and GPS receivers.

### Syllabus

- **Introduction to positioning and navigation systems:** Basic definitions, positioning methods: ranging, bearing and dead reckoning, Sensors used for navigation and navigation systems technologies.
- **Coordinate systems and Transformations:** Inertial, earth, and body coordinate systems, altitude methods for representing angular positions and converting between them, angular velocities, methods for representing angular positions and converting between them, angular velocities, derivation of the rotation matrix and rotation quadrilaterals, conversion between basic coordinate systems, the Earth model.
- **Gyroscopes:** Mechanical gyroscopes, fiber-optic gyroscope FOG, Ring Laser Gyroscope, vibration gyroscopes, MEMS microelectromechanical gyroscopes.
- **Accelerometers:** Working principle, types of accelerometers, accelerometer error model.
- **Inertial navigation system:** Strapdown Mechanization, positioning algorithm, attitude determination algorithm, error model.
- **INS/GPS Integrated navigation:** The Global Positioning navigation, INS/GPS integrated navigation.