

(1.) Course Title: INFPHD641 Developing web applications with maps (complex exam preparatory)	Credits: 6
Course Classification: Mandatory chosen	
Theoretical or Practical Nature of the Course, ' <i>training character</i> ' ¹³ : 50%-50% (credit%)	
Type of Class: practice and number of hours: 2/week in the given semester, (If the course is not (only) taught in Hungarian, then <i>the language: English</i>) Additional (specific) methods and characteristics² used in delivering the knowledge (if any): -	
Assessment Method (Exam / Midterm Grade / Other³): practical course marc Additional (specific) methods⁴ applied in knowledge assessment (if any): -	
Course Placement in Curriculum (Semester Number): -	
Prerequisites (if any): Basic knowledge of JavaScript is recommended	
Course Description: A concise yet informative description of the knowledge to be acquired.	
The exam focuses on the principles, technologies, and applications of web mapping APIs and geospatial services. Students are expected to demonstrate knowledge of the most commonly used open-source web mapping APIs, including their advantages and limitations. Topics include raster map data formats and sources, such as TMS, WMS, and georeferenced images, as well as vector geodata formats commonly used on the client side, including GeoJSON and vector tiles. Students should be familiar with freely available geocoding, routing, and other geospatial services, and understand how to integrate them into interactive web maps. The exam also covers the Cesium.js virtual globe API, including its strengths, weaknesses, and practical examples of use. Students are expected to combine theoretical understanding with practical knowledge to evaluate and implement web mapping solutions effectively. • Introduction to Web Mapping APIs. General concepts and purposes. • Open-Source Web Mapping APIs. Overview of the most popular options, including pros and cons. Introducing Leaflet • Raster Map Data Formats. TMS, WMS, and georeferenced image formats. • Raster Data Sources. Typical providers and accessibility. • Vector Geodata Formats on Client Side. GeoJSON, vector tiles, and their usage. • Geocoding Services. Freely available options and integration into web maps. • Routing Services. Overview of open routing services and their web integration. • Other Geospatial Services. Additional services (e.g., POI search, spatial analysis) for web mapping. • Cesium.js Virtual Globe API. Features, advantages, limitations, and example applications.	

2-5 Most Important Required and Recommended Literature

List of required and recommended literature (notes, textbooks) with bibliographic data (author, title, publication details, (possibly pages), ISBN).

- Gábor Farkas: Mastering OpenLayers 3. <https://www.packtpub.com/product/mastering-openlayers-3/9781785281006>
- Paul Crickard: Leaflet.js Essentials. <https://www.packtpub.com/product/leafletjs-essentials/9781783554812>
- Gede Mátyás: The OpenLayers 5 API. <http://mercator.elte.hu/~saman/edu/ol5/>
- Leaflet API reference. <https://leafletjs.com/reference.html>
- CesiumJS tutorial and reference. <https://cesium.com/learn/cesiumjs-learn/>

List of Prescribed Professional Competencies and Competency Elements

(knowledge, skills, etc., KKK Section 8) that the course significantly contributes to developing (highlight the most important ones).

a) Knowledge

- Possess the necessary research methodological skills for independent research in a given discipline/subject.
- Knowledge of the general principles, rules and traditions of information technology and GIS.
- Knowledge of the specific tools of the field of spatial computing, mastery of data management and analysis, understanding and effective application of cartographic representation in GIS environment;
- Knowledge and use of spatial data collection technologies, their geospatial aspects and key elements.

b) Skills

- Ability to design and implement new projects, conduct research in a given field, develop new techniques and approaches.
- The ability to select the most effective GIS tools and software for the task in hand, depending on the complexity of the task.
- Ability to process, evaluate, interpret and analyse data systematically using GIS and to support the drawing of conclusions from this data in GIS terms and to visualise them in an optimal way.
- With the acquired knowledge of spatial information and cartography, the PhD student is able to carry out planning, development and consultancy tasks in an efficient, user-oriented manner in the operation of GIS, decision support systems and expert systems.

c) Attitudes

- Have the interest and learning ability to keep abreast of the current state of the art in the field the identification and solution of unforeseen research problems in the field, which are currently not yet transparent.

- The acquisition of a geospatial approach will help to develop an appropriate attitude to professional cooperation with professionals working in related fields.

d) Autonomy and Responsibility

- The PhD student develops and initiates new research areas within spatial computing and initiates new practical solutions with creative autonomy.

- Ability to act as an equal and discussion partner with professionals in the field.

- With his/her knowledge and skills in GIS, he/she is able to work responsibly with professionals from other disciplines.

Course responsible (name, position, academic degree): **Dr. Mátyás Gede, associate professor, PhD**

Instructor(s) involved in teaching the course (if any) (name, position, academic degree):

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