# COURSE DESCRIPTION CARD

<table>
<tr><td colspan="10">Faculty of Civil Engineering and Environmental Sciences</td></tr>
<tr><td>Field of study</td><td colspan="6"></td><td colspan="2">Degree level and programme type</td><td></td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="6">-</td><td colspan="2">Study profile</td><td>Academic profile</td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">M-3. Mapping and 3D modelling</td><td colspan="2">Course code</td><td>IS-FCEE-00272W</td></tr>
<tr><td colspan="2">Course type</td><td>Erasmus</td></tr>
<tr><td rowspan="2">Forms and number of hours of tuition</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>V</td><td>Semester</td><td>winter</td></tr>
<tr><td></td><td></td><td></td><td></td><td>15</td><td></td><td></td><td>No. of ECTS credits</td><td>1</td></tr>
<tr><td>Entry requirements</td><td colspan="9">No requirements</td></tr>
<tr><td>Course objectives</td><td colspan="9">The aim of the activities included in this unit is to make students aware of need of cooperation to develop the ability to apply the basic knowledge of Mapping and 3D modelling (elements of GIS, BIM, theory of digitalization of heritage objects, principles of smart city, remote sensing methods and software systems for spatial 3D modelling of surfaces, to analyse data and their potential for use in the development of cartographic products, 3D mapping and modelling, drawing techniques, from hand drawing to computer programmes) to use the methods and software systems for spatial 3D modelling, and to be able to create a 3D printing model</td></tr>
<tr><td>Course content</td><td colspan="9">Activities included to reach this aim are very different. They include:<br>material accessed on www.glocal.pb.edu.pl prepared by 3 European Universities<br>The aim of the SW classes (lectures, project) to give a basic approach to understand the general knowledge needed for the course and the team design for the project of a bus stop shelter in different European cities locations.<br>The aim is presentation of the newest modern remote sensing technologies to create spatial surface 3D models and collect reliable data.<br>The goal is achieved through:<br>SW (L- Lecture):<br>- Infrastructure for Spatial Information in the European Community (INSPIRE)<br>- Rules for flying unmanned aircraft UAV-photogrammetry innovative technology for aerial mapping of territories<br>- BIM principles, smart city principles<br>- Drawing techniques: from hand drawing to computer programmes, 3D printing.<br>- Surveying using remote sensing technologies (Remote sensing technologies to create spatial surface 3D models.)<br>- Presentation and discussion of the different techniques and rules GIS, BIM, smart city principles, rules of UAV - photopgrammetry<br>Presentation and discussion of basic knowledge of the contents related to it. Discussion and exchange of thoughts on examples presented on the lectures.</td></tr>
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| | The aim of the SW project is to select a remote sensing technique to solve cartographic and spatial information creation problems.<br>The goal will be achieved through:<br>-presentation and discussion of remote sensing data selected types.<br>-discussion and exchange of thoughts on appropriately uses methods for assessing the reliability of remote sensing data by organizing and analyzing 3D models.<br>- solves a wide range of engineering problems by creating cartographic data sets based on remote sensing information.<br>- performs measurements with laser scanning equipment and properly prepares digital map data in accordance with the applicable legislation and the latest regulations on geodesy and cartography<br>-analyses the results of object scans and prepares remote sensing data for processing.<br>-creates 3D digital models of the Earth's surface and various objects based on data from remote sensing systems<br>-discussion of the results and solutions proposed by student teams. Possible correction of proposed solutions. The developed solution will be used for further activities at the next workshop<br>-presentation and discussion of basic knowledge of the contents related to it.<br>-discussion and exchange of thoughts on appropriately uses of methods for assessing the possibility of using models done with 3D computer software to print 3D scale models.<br>- using 3D digital models for basic project development of a bus stop shelter designed by the team.<br>- solving basic problems with the help of the 3D expert teachers.<br>- analyzing the best way to improve a 3D digital model, with the help of the 3D expert teachers, for 3D printing.<br>-discussion of the results and solutions proposed by student teams. Possible correction of proposed solutions.<br>- performs 3D printing of selected student proposals.<br>Assessment: Test and the developed team solution will be used for Final Oral Presentation of the 3 students team project. | |
| **Teaching methods** | Lectures, individual study (e-learning materials), laboratory classes, field work, specialization workshop (SW) and project classes (P), carrying out a design work for small architecture object in a team of 3 students from different universities | |
| **Assessment method** | Final test (E-learning part) and Final Oral Presentation of the team for design work defence and evaluation of design work (Face-to Face part) | |
| **Symbol of learning outcome** | **Learning outcomes** | **Reference to the learning outcomes for the field of study** |
| **LO1** | The graduates show understanding of the different techniques for graphic representation used for architecture and Engineering projects and of the traditional methods to create graphic representation of 3D objects (as a bus stop shelter) and the results of it, such as project plans and select the best of them for specific tasks. | GLOCAL_M3_K11 (K_GP1_W06, K_AK1_W11) |
| **LO2** | The graduates show understanding of the new techniques to create computer 3D models (BIM) of a bus stop shelter and analyze available programs (Autocad, Revit…) to select the best of them for specific tasks. | GLOCAL_M3_K12 (K_GP1_W13, K_GP1_W04, K_AK1_W11) |
| **LO3** | The graduates show general understanding of the different techniques used for 3D printing in building construction and Engineering and analyze different programs and printing materials to select the most appropriate for specific tasks. | GLOCAL_M3_K13 (K_GP1_W13, K_AK1_W11) |

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| **LO4** | The graduates show understanding of the application of remote sensing data reliability assessment methods for 3D model analysis. | GLOCAL_M3_K14 (K_GP1_W04) |
| **LO5** | The graduates properly understands the methods for analyzing the results of scanning of objects and of preparing remote sensing data for processing. | GLOCAL_M3_K15 (K_GP1_W04) |
| **LO6** | The graduates show understanding of methods of analyzing the results of scanning of objects and of preparing remote sensing data for processing. | GLOCAL_M3_K16 (K_GP1_W04) |
| **LO7** | The graduates knows principles of BIM, GIS technology in smart cities | GLOCAL_M3_K17 (K_GP1_W13, K_GP1_W04, K_AK1_, U14) |
| **LO8** | The graduates can use innovative techniques to create computer 3D models (BIM) with AutoCAD and Revit programs of a bus stop shelter and apply them to produce results such as project plans. | GLOCAL_M3_S06 K_GP1_U13, K_AK1_U01) |
| **LO9** | The graduates can analyze the results of solving engineering problems in creating 3D models (BIM) and face basic problems related to it, by cooperating in their teams to solve them. | GLOCAL_M3_S07 (K_GP1_U13) |
| **LO10** | The graduates can apply techniques for 3D printing, from 3D computer models. | GLOCAL_M3_S08 (K_AK1_U01) |
| **LO11** | The graduates is able to apply innovative remote sensing techniques to create spatial models of surfaces. | GLOCAL_M3_S09 (K_GP1_U08) |
| **LO12** | The graduates is able to make the selection of the appropriate remote sensing method for solving mapping problems. | GLOCAL_M3_S10 (K_GP1_U08, K_GP1_U07) |
| **LO13** | The graduates is able to analyze of the results of solving engineering problems in creating cartographic datasets. | GLOCAL_M3_S11 (K_GP1_U08, K_GP1_U07, K_AK1_U02) |
| **LO14** | The graduates are able to take measurements with laser scanning equipment and to prepare measurement data in accordance with current regulations. | GLOCAL_M3_S12 (K_GP1_U04) |
| **LO15** | The graduates can use engineering knowledge to shape the awareness of society, professional and ethical, and take responsibility for their activities | GLOCAL_ SC01 (K_GP1_K05) |
| **LO16** | The graduates can communicate effectively in a variety of intercultural contexts, reflect critically on stereotypical cultural perceptions of reality, Sustainable development in revitalization (renovation, revaluation) of public urban areas, and thus, are able to accept cultural diversity and differing points of view | GLOCAL_SC03 (K_AK1_U16, K_AK1_U17) |
| **LO17** | The graduates can formulate and communicate to the public, in a commonly understood way, information and opinions concerning urban design, the integration of new elements in the historic urban context of European cities, presenting different points of view | GLOCAL_SC04 (K_AK1_U16, K_AK1_U17) |
| **LO18** | The graduates can reliably and responsibly perform the assumed or assigned professional roles, taking into account the social determinants of the surrounding environment, as skills for multidisciplinary project development. | GLOCAL_SC07 K_GP1_K06, K_AK1_U18) |
| **Symbol of learning outcome** | **Methods of assessing the learning outcomes** | **Type of tuition during which the outcome is assessed** |
| **LO1** | Defence of the completed project (final oral presentation) | SW |
| **LO2** | Defence of the completed project (final oral presentation) | SW |
| **LO3** | Defence of the completed project (final oral presentation), test | SW |

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| **LO4** | Defence of the completed project (final oral presentation) | SW |
| **LO5** | Defence of the completed project (final oral presentation) | SW |
| **LO6** | Defence of the completed project (final oral presentation) | SW |
| **LO7** | Defence of the completed project (final oral presentation), test | SW |
| **LO8** | Defence of the completed project (final oral presentation) | SW |
| **LO9** | Defence of the completed project (final oral presentation) | SW |
| **LO10** | Defence of the completed project (final oral presentation) | SW |
| **LO11** | Defence of the completed project (final oral presentation) | SW |
| **LO12** | Defence of the completed project (final oral presentation) | SW |
| **LO13** | Defence of the completed project (final oral presentation) | SW |
| **LO14** | Defence of the completed project (final oral presentation) | SW |
| **LO15** | Defence of the completed project (final oral presentation) | SW |
| **LO16** | Defence of the completed project (final oral presentation) | SW |
| **LO17** | Defence of the completed project (final oral presentation) | SW |
| **LO18** | Defence of the completed project (final oral presentation) | SW |

| **Student workload (in hours)** | | **No. of hours** |
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| **Calculation** | Participation in the SW lecture. | 7 |
| | Participation in specialization workshop. | 8 |
| | Student individual work including test | 10 |
| | **TOTAL:** | 25 |

| **Quantitative indicators** | **HOURS** | **No. of ECTS credits** |
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| **Student workload – activities that require direct teacher participation** | 15 | 0,75 |
| **Student workload – practical activities** | 10 | 0,25 |

**Basic references**


Urban public spaces: Madrid, Bialystok, Klaipeda. A guide to their functions and meaning (2022) María Aurora Flórez de la Colina
Pilar Cristina Izquierdo Gracia, Dorota Gawryluk Editors, Wydawnictwo Ekonomia i Środowisko (available on: https://glocal.pb.edu.pl/en/results/ )
Future of the City (2021, 2022) Dorota Gawryluk, Dorota Anna Krawczyk Editors, Oficyna Wydawnicza Politechniki Białostockiej (available on: https://glocal.pb.edu.pl/en/results/ )
Small Glossary of Technical Terms for English–Polish–Spanish–Lithuanian Languages (2020) Dorota Gawryluk, Jurga Kucinskiene, Sausdino UAB „Vitae Litera" (available on: https://glocal.pb.edu.pl/en/results/ )
Keranen, K.; Kolvoord, R. (2016). Making Spatial Decisions Using GIS and Lidar: A Workbook. Redlands: Esri Press Academic.
Weng, Q. (2010). Remote Sensing and GIS Integration: Theories, Methods, and Applications. New York (N.Y.): McGraw Hill.
Chang, N.; Bai, K. (2018). Multisensor data fusion and machine learning for environmental remote sensing. Taylor & Francis Group, 2.
Chuvieco, E. (2020). Fundamentals of satellite remote sensing: an environmental approach. Boca Raton: CRC Press.
National Ocean Service. What is LiDAR. (2022). Available from: https://oceanservice.noaa.gov/facts/lidar.html.
Tomlin, C. D. (2013). GIS and Cartographic Modelling. Redlands, California: Esri Press.

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| | glocal.pb.edu.pl | |
| **Supplementary references** | | |
| **Organisational unit conducting the course** | **BUT, FCEES,<br>Department of Sustainable Construction and Building Systems** | **Date of issuing the programme** |
| **Author of the programme** | **Wojciech Matys, PhD, Eng. arch., Waldemar Łupiński, PhD, Eng., Marcin Gryniewicz, PhD, Eng.** | **12.11.2022** |

**L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, V-virtual part , S – seminar**