MEEB505 Building Environmental Design Tools – Building Information Modelling

Course Title	Building Environmental Design Tools – Building Information Modelling				
Course Code	MEEB505				
Course Type	Compulsory				
Level	Masters (2nd Level)				
Year / Semester	1st year/ 2nd semester or 2nd year/ 3rd semester				
Teacher's Name	Mr. Nicos Georgiou, Mr. Joseph Georgiou				
ECTS	10	Lectures / week	1	Laboratories/week	2
Course Purpose	Building energy performance simulations (BEPS) are an essential part of the assessment process of buildings energy efficiency. Independently of the BEPS software used to conduct an energy simulation, the typical process of preparing a model involves repetitive manual operations that often lead to duplication of existing data, data losses and errors. In order to improve the method of information exchange in the Construction industry, recent efforts have concentrated on integrating Building Information Modelling (BIM) with BEPS tools. Building Information Modeling (BIM) is an intelligent 3D model-based process that gives architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure. Many countries are already implementing BIM as a mandatory requirement for public works following the recommendation of the European Public Procurement Directive 2014 / 24 / EU and, that in the near future, will be extended to the rest of the projects. The overall goal of the course is that the student shall achieve the ability to independently and creatively identify and evaluate different energy conservation measures for a building through systematic analysis and simulation of the building's energy performance using energy analysis tools of BIM software. Another purpose of this course is to introduce BIM in a theoretical and conceptual way to students in order to remain competitive in the buildings energy sector. The objective of this course is to offer an advanced education programme on BIM integrated design, construction and operation processes, with a strong focus on the energy assessment of buildings that are the cornerstone of such integration.				
Learning Outcomes	Upon completion of the course, the student shall be able to: 1. Demonstrate knowledge of current research and development work within the field of energy efficiency of buildings 2. Model and simulate a building's energy performance with BIM simulation software 3. Gain insight into renovation and energy optimization from the perspective of sustainable development 4. Simulate a building's energy model and analyse several energy-efficiency measures in the model to obtain the best energy savings scenario 5. Discuss the advantages and disadvantages of energy efficient building concepts. 6. Understand the role and potential of BIM for the industry 7. Be able to plan the use of BIM in Building projects and provide the right level of detail 8. Be able to comply legal and project collaboration requirements 9. Capability to understand and perform BIM models for the specialties of Architecture, Structural Engineering and MEP Engineering 10. Master the use of parametric approaches for advanced object creation 11. Be capable of advanced object use in BIM context through interactive editors and object libraries 12. Detail and apply the business processes impacted by BIM 4D, 5D and 6D and describe the digitalization approach in terms of workflows, data exchange mechanisms				
Prerequisites	MEE520			Corequisites	None
Course Content	**1. Introduction to Building Energy Performance Simulation**				

	- Energy conservation measures for buildings.
	- General energy efficiency and environmentally friendly measures
	- Energy consumption in buildings depending on
	  - design and equipment,
	  - outdoor climate,
	  - indoor conditions,
	  - HVAC systems
	- Energy performance simulations using computer software
	- Effects of implementing energy efficiency measures
	- Energy efficient building concepts (Near Zero Energy buildings, Passive houses)
	2. Introduction in BIM
	- Differentiation of the requisites and uses that are of interest for each construction specialty (Architecture and Engineering);
	- Adequate modelling practices in view of intended uses for the models;
	- Modelling recommendations that exist at international level;
	- Perform BIM models for the specialties of Architecture and MEP Engineering;
	- Particular cases of modelling, targeted for monitoring and management.
	3. BIM in Practice
	- Common Information and Data Environment
	- Drawings Management
	- Protocol and Procedures
	- Level of Detail and Volumes
	- Templates
	- Benefits of BIM - Essential Requirements
	4. Case Study
	- Step-by-step simulation of a mock-building with the use of Autodesk Revit
	- Parametric energy analysis of the building
	- 4D and 5D aspects of buildings design stage

Teaching Methodology	For the theoretical part of the course, the course will be presented through theoretical lectures in class. The lectures will present to the student the course content and allow for questions. The material will be delivered using visual aids (e.g. PowerPoint presentation slides, documentaries). The aim is to familiarize the student with the material at a faster pace of presentation, while allowing the instructor to use the presented material for meaningful discussions. The learning process will be enhanced with the requirement from the student to carry in-class discussions and tackling of hypothetical scenarios in small-group exercises. In-class case-studies are an integral part of this course. Homework assignments / mini projects, which will be required as part of the students' assessment for the course, will allow students the opportunity to carry out independent research, synthesize basic concepts presented in class, as well as hone their analytical, writing and presentation skills. For the laboratorial part of the course, the students will attend on a weekly basis lectures in Frederick's computer labs and will be educated to become proficient users of a BIM software tool (Autodesk Revit). Besides from the notes taken by students in class, all of the course material will be made available through the class website which will be available through the University's E-learning platform. The instructor will be available to students during office hours or by appointment in order to provide necessary guidance.
Bibliography	**Textbooks:** - Borrmann, A, König, M, Koch, C, Beetz, J. (2019). Building Information Modeling Technology Foundations and Industry Practice. Springer Cham. - Hensen, J.L.M. and R. Lamberts (2011). Building performance simulation for design and operation. Oxon, UK, Spon Press. **References:** - Bokmiller, D., Whitbread, S., & Hristov, P. (2013). Mastering Autodesk Revit MEP 2014: Autodesk Official Press. John Wiley & Sons.

	- Borrmann, A, König, M, Koch, C, Beetz, J. (2019). Building Information Modeling Technology Foundations and Industry Practice. Springer Cham. - Hensen, J.L.M. and R. Lamberts (2011). Building performance simulation for design and operation. Oxon, UK, Spon Press. - Bokmiller, D., Whitbread, S., & Hristov, P. (2013). Mastering Autodesk Revit MEP 2014: Autodesk Official Press. John Wiley & Sons - Autodesk Revit Manual
Assessment	- Laboratory work 25% - Project work: written report and presentation 25 % - Final exams 50%
Language	English