APPROVED

INTR8043: Digital Design & Construction

Module Details

Module Code:	INTR8043
Title:	Digital Design & Construction APPROVED
Long Title:	Digital Design & Construction
NFQ Level:	Advanced
Valid From:	Semester 1 - 2022/23 (September 2022)

Duration:	1 Semester

Credits:	10

Field of Study:	5213 - Interdisciplinary Engineering

Module Delivered in:	**1 programme(s)**

Module Description:	Virtual Design and Construction (VDC) is the management of integrated multi-disciplinary performance models of built environment projects, thereby enabling the development and testing of a digital prototype in advance of the commencement of construction on site. A VDC approach enables models to be used for effective communication and sharing of information, execution of multiple iterations of specific analysis (e.g. clash rendition, energy analysis, structural analysis, cost analysis and construction programming). Learners will use digital technologies and industry best practice processes to facilitate data capture and management of multi-disciplinary performance models within a cloud based Common Data Environment (CDE). Learners will collaboratively undertake a multi-disciplinary AEC project with a key focus on efficient data capture (e.g. laser scanning, data matrix technology), management via a Federated Model within a CDE, efficient interrogation and manipulation of data by adopting a visual scripting approach, and communication via cloud based applications and/or immersive technologies.

Learning Outcomes

On successful completion of this module the learner will be able to:

#	Learning Outcome Description
LO1	Describe, apply and critically appraise methodologies and technologies pertinent to the capture, management, interrogation, use and sharing of discipline specific model data.
LO2	Use and evaluate data capture techniques (e.g. laser scanning, data matrix scanning) utilised at various stages in the design and construction process.
LO3	Use an appropriate digital technology to import and combine domain-specific BIM models from a variety of technologies in the execution of a federated model strategy and apply domain-specific model checking and combined model checking within the federated model application.
LO4	Use and evaluate cloud based technologies and immersive technologies in the communication and validation of data relevant to the design and/or construction phases of a project.
LO5	In accordance with industry BIM standards and a project specific BIM Execution Plan (BEP), apply appropriate information authoring, modelling and management technologies within a team based interdisciplinary environment to create and validate coordinated multidisciplinary models.

Dependencies

Module Recommendations

Incompatible Modules

No incompatible modules listed

Co-requisite Modules

No Co-requisite modules listed

Requirements

No requirements listed

Indicative Content

Virtual Design and Construction (VDC)
General principles; VDC in the context of BIM; Typical and potential methodologies and technologies; Examination of the role of VDC in the integration of multi-disciplinary performance models to act as a digital prototype for testing in advance of construction in the first case, and to then develop as a 'digital twin' of the physical asset, containing all data relevant to the design, construction and operations phases.

Federated Model
Federated Model applications; Correct export and import procedures using shared coordinates; Real time navigation within the federated model with data visibility adjustment techniques; Developing clash avoidance methodologies; Generating interactive 3D, 4D, 5D and 6D simulations from the Federated Model; Applying combined model checking procedures within the federated model.

Common Data Environment (CDE)
Fundamental components which comprise a CDE; Current and future options in terms of deploying a project appropriate CDE; Business considerations, as well as legal and security issues, of individual project contributors sharing data via a CDE.

Immersive Technology
Potential for immersive technology to be a powerful collaborative and communication tool; Current benefits and limitations, as well as future potential to disrupt traditional AEC workflows to positive effect.

Automation
Introduction to automated digital technology and its potential to facilitate lean processes within the AEC sector by reducing time-demanding tasks; Application of common industry automation technology (e.g. Dynamo, Grasshopper).

Data Capture
Identifying, testing and evaluating various methods of data capture. Laser scanning, with potential uses including the capture of: As-is geometry and visual record of existing buildings/elements of infrastructure; Topographical data using associated drone technology; Construction progress data using associated drone and robotic technology; As-built data. Ground penetrating radar to develop accurate models of underground services. Intelligent data matrix technologies in combination with cloud computing to capture operation and maintenance data.

Collaborative Culture
Effective multidisciplinary AEC project delivery via immersion within a culture of knowledge sharing, information sharing, collaboration, and integrated project delivery using a real-world context within a safe educational setting.

Reflection
Collaborative processes will evolve over time, while supporting digital technologies are likely to experience ongoing and potentially significant evolution. Consequently, the ability of individuals and teams to reflect on existing practices and subsequently develop new practices will be increasingly significant.

Module Content & Assessment

Assessment Breakdown	%
Coursework	100.00%

Assessments

Coursework			
Assessment Type	Presentation	**% of Total Mark**	20
Timing	Week 3	**Learning Outcomes**	1
Assessment Description			
Technical presentation identifying and evaluating potential CDE options in the management of project information including graphical data (i.e. federated model), non-graphical data and documentation.			
Assessment Type	Written Report	**% of Total Mark**	30
Timing	Week 6	**Learning Outcomes**	1,3,4
Assessment Description			
Technical Report addressing some/all of the following: Assessment of federated model in terms of import/export procedures; Interference and clash detecting reports; Execution of 3D/4D/5D/6D simulation options; Apply domain-specific model checking and combined model checking within the federated model application; Automation and Immersive Technology			
Assessment Type	Project	**% of Total Mark**	50
Timing	Sem End	**Learning Outcomes**	1,3,4,5
Assessment Description			
The collaborative group-based design project will include key considerations of the design, construction, and operation stages. Products of the process, which may include sketches, 3D information-centric models, schedules, 3D/4D/5D/6D simulations, shall be presented with in a Common Data Environment (CDE). Upon completion of the project work, each team is required to deliver an oral presentation on their project work.			

No End of Module Formal Examination

Reassessment Requirement
Repeat the module
The assessment of this module is inextricably linked to the delivery. The student must reattend the module in its entirety in order to be reassessed.

Module Workload

Workload: Full Time

Workload Type	Contact Type	Workload Description	Frequency	Average Weekly Learner Workload	Hours
Lecture	Contact	Delivery of module content.	Every Week	1.00	1
Lecturer-Supervised Learning (Contact)	Contact	Delivery of practical instruction; Execution of formative and summative assignments/assessments.	Every Week	3.00	3
Independent & Directed Learning (Non-contact)	Non Contact	Revision of module content; Execution of assignments /assessments.	Every Week	10.00	10
				Total Hours	14.00
				Total Weekly Learner Workload	14.00
				Total Weekly Contact Hours	4.00

Workload: Part Time

Workload Type	Contact Type	Workload Description	Frequency	Average Weekly Learner Workload	Hours
Lecture	Contact	Delivery of module content.	Every Week	1.00	1
Lecturer-Supervised Learning (Contact)	Contact	Delivery of practical instruction; Execution of formative and summative assignments/assessments.	Every Week	3.00	3
Independent & Directed Learning (Non-contact)	Non Contact	Revision of module content; Execution of assignments /assessments.	Every Week	10.00	10
				Total Hours	14.00
				Total Weekly Learner Workload	14.00
				Total Weekly Contact Hours	4.00

Module Resources

Recommended Book Resources

Rafael Sacks, Chuck Eastman, Ghang Lee, Paul Teicholz. (2018), BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Third. John Wiley & Sons, [ISBN: 978111928753].

Lennard Andersson, Kyla Farrell, Oleg Moshkovich, Cheryle Cranbourne. (2016), Implementing Virtual Design and Construction using BIM: Current and future practices, Routledge, [ISBN: 1138019941].

This module does not have any article/paper resources

Other Resources

Standard, International Standards Organisation (ISO). (2018), ISO 19650-1:2018 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 1: Concepts and p.

Standard, International Standards Organisation (ISO). (2018), ISO 19650-2:2018 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 2: Delivery phase.

Guidance Document, Construction Industry Federation (CIF) 2018, CIF BIM Starter Pack,
  https://cif.ie/wp-content/uploads/2018/1 1/BIM-Starter-Pack-LBIC-CIF-ZZ-XX-GD-Z-0 003.pdf

Website, Solibri Model Checking,
  https://www.solibri.com/

Standard, BS 7400-4 Design management systems. Guide to managing design in construction, BSi UK.

Module Delivered in			
Programme Code	**Programme**	**Semester**	**Delivery**
CR_CBIMM_8	**Bachelor of Science (Honours) in Building Information Modelling and Management**	-1	Mandatory

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CR_CBIMM_8	**Bachelor of Science (Honours) in Building Information Modelling and Management**	-1	Mandatory