

## Module specification

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Module code	ENG796
Module title	Generative Design and Immersive Realities
Level	7
Credit value	20
Faculty	FAST
HECoS Code	100048
Cost Code	GAME

### Programmes in which module to be offered

Programme title	Is the module core or option for this programme.
MSc Innovative Design MSc Innovative Design with Advanced Practice	Core

### Pre-requisites

None

### Breakdown of module hours

Learning and teaching hours	20 hrs
Placement tutor support	0 hrs
Supervised learning e.g., practical classes, workshops	10 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
<b>Total active learning and teaching hours</b>	<b>30 hrs</b>
Placement / work-based learning	0 hrs
Guided independent study	170 hrs
<b>Module duration (total hours)</b>	<b>200 hrs</b>

For office use only	
Initial approval date	22 <sup>nd</sup> Aug 2022
With effect from date	Sept 2022
Date and details of revision	
Version number	1

### Module aims

This module is aimed at introducing the concepts and theoretical frameworks of generative design and immersive realities to students in the context of real-world applications. The modelling and formulation of generative design problems will be practically examined via

design exploration implemented by design optimization. In this way, students are introduced to algorithmic frameworks and relevant mathematical modelling principles for the conduct of numerical optimization. Present-day state-of-the-art digital and emerging technological paradigms such as augmented and virtual realities aiding 3-D design analysis and visualization will also be taught to students. Practical parametric 3-D design and modelling of a contemporary device will also be demonstrated to students using computer-aided design (CAD) tools such as Computer Simulation Technology Suite and MATLAB.

### Module Learning Outcomes - at the end of this module, students will be able to:

1	Analytically and mathematically describe a generative design problem and formulate/model real-world generative design problems.
2	Critically evaluate real-world applications for augmented reality and virtual reality technologies.
3	Address a practical product design problem using generative design methodologies.

### Assessment

Indicative Assessment Tasks:

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

**Assessment One:** An individually prepared portfolio consisting of a range of assessments such as case studies, laboratory work and Moodle Quiz, introducing the topic areas of each learning outcomes. Guidance material will be provided, which the students will use to generate a Portfolio of work. Assessment one is an individual prepared portfolio and represents 100% of the overall module mark.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	1-3	Portfolio	100%

### Derogations

None

### Learning and Teaching Strategies

A series of workshop style lectures with student-led seminars and small group activities. Directed learning using library and internet resources will be facilitated using Moodle and MS Teams. This module will also follow the ALF (Active Learning Framework) guidelines, which will include alternative methods of assessment and a blended approach to delivery, with some theory and software sessions being delivered online (depending on requirements and student experience).

## Indicative Syllabus Outline

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- Mathematical Programming for Generative Design (Numerical Optimization Methods; Formulation of Generative Design Problems (Objective Functions, Constraint Functions and Penalized Functions); Topology Optimization for Generative Design (Parametric Modelling and Design and Topological Evolution)
- Fundamentals of Augmented Reality (AR) and Virtual Reality (VR), Architecture, Real world applications of AR and VR, Human Senses and Their Relationship to Output / Input Devices, Devices to Enable Interaction with Data, Human Factors, Legal and Social Considerations, Latest Technologies – 5G, Metaverse, etc.
- Guided Laboratory Work (Generative Design of a Product (such as Microwave Antenna))

## Indicative Bibliography:

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### Essential Reads

J. R. R. A. Martins, et. al., *Engineering Design Optimization*. Cambridge: Cambridge University Press, 2022.

### Other indicative reading

S. Aukstakalnis, *Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR*. Boston: Addison-Wesley Professional, 2017.

Plus, various others to be signposted on Moodle.

## Employability skills – the Glyndŵr Graduate

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Each module and programme is designed to cover core Glyndŵr Graduate Attributes with the aim that each Graduate will leave Glyndŵr having achieved key employability skills as part of their study. The following attributes will be covered within this module either through the content or as part of the assessment. The programme is designed to cover all attributes and each module may cover different areas.

### Core Attributes

Engaged  
Enterprising  
Creative  
Ethical

### Key Attitudes

Commitment  
Curiosity  
Resilience  
Confidence  
Adaptability

### Practical Skillsets

Digital Fluency  
Organisation  
Critical Thinking

Emotional Intelligence  
Communication