

<b>Module Title:</b>	Microelectronic Design 1
<b>Language of Instruction:</b>	English
<b>Credits:</b>	10
<b>NFQ Level:</b>	8
<b>Module Delivered In</b>	<a href="#">2 programme(s)</a>
<b>Teaching &amp; Learning Strategies:</b>	Teaching will take the form of problem-based learning during tutorials and practical classes. An emphasis will be placed on relating individual circuits and devices to useful practical applications both in theory and practical classes. Circuit simulation software will be used extensively in the problem-solving sessions to validate students' solutions.
<b>Module Aim:</b>	To provide: (a) Detailed analyses of semiconductor devices and their CAD models. (b) Knowledge of circuit-level simulation and layout tools. (c) Methodologies for digital and analogue IC analysis and design.
<b>Learning Outcomes</b>	
<i>On successful completion of this module the learner should be able to:</i>	
LO1	Carry out a variety of simulations using a modern circuit simulator.
LO2	Derive and utilise semiconductor device models in circuit design simulations.
LO3	Layout and verify integrated circuit designs.
LO4	Design and analyse integrated amplifier circuits and cascodes.
LO5	Design and analyse current mirrors & reference circuits.
LO6	Design and analyse differential amplifiers.
<b>Pre-requisite learning</b>	
<b>Module Recommendations</b> <i>This is prior learning (or a practical skill) that is recommended before enrolment in this module.</i>	
No recommendations listed	
<b>Incompatible Modules</b> <i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module.</i>	
No incompatible modules listed	
<b>Co-requisite Modules</b>	
No Co-requisite modules listed	
<b>Requirements</b> <i>This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.</i>	
Students should have completed a module equivalent to the following from CW527: Analysis of Analogue Circuits (yr3).	

## Module Content & Assessment

### Indicative Content

#### 1. Circuit Simulation & Layout

SPICE Device Elements; Semiconductor Devices; Analysis Modes and Techniques; Full-Custom IC Layout.

#### 2. Semiconductor Fabrication

Wafer Preparation and Mask-making; Layering, Patterning and Doping; Electrical Tests and Die Packaging.

#### 3. Semiconductor Device Modelling

Semiconductor Materials and their Properties; PN Junction and BJT Modelling; MOSFET Modelling; Amplifier Configurations.

#### 4. Amplifier & Cascode Configurations

BJT & MOS integrated amplifiers; Cascoded transconductors and loads.

#### 5. Current Mirrors & References

MOS and bipolar Current Mirroring; Temperature and Sensitivity Analysis; Voltage and Current Referencing.

#### 6. Differential Amplifiers

Qualitative Analysis and Bipolar/MOSFET Differences; Small-Signal and Large-Signal Analysis; Cascode Differential Amplifiers; Common-Mode Rejection; Use of Active Loads.

Assessment Breakdown	%
Continuous Assessment	20.00%
Practical	20.00%
End of Module Formal Examination	60.00%

### Continuous Assessment

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Examination	Students will sit a written examination during the module.	2,4,5,6	20.00	n/a

No Project

### Practical

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Practical/Skills Evaluation	Students will complete a series of practical assignments, under supervision, using circuit simulation software.	1,2,3,4,5,6	20.00	n/a

### End of Module Formal Examination

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Formal Exam	A written examination, at the end of the module, will examine the extent of the student's achievement of the learning outcomes.	1,2,3,4,5,6	60.00	End-of-Semester

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

**Module Workload**

<b>Workload: Full Time</b>		
<i>Workload Type</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	Every Week	4.00
Practicals	Every Week	3.00
Independent Learning Time	Every Week	3.00
Total Hours		10.00

**Module Delivered In**

Programme Code	Programme	Semester	Delivery
CW_EEBEE_B	<a href="#">Bachelor of Engineering (Honours) in Biomedical Electronics</a>	7	Mandatory
CW_EESYS_B	<a href="#">Bachelor of Engineering (Honours) in Electronic Engineering</a>	7	Mandatory