DSGN C4601: Microelectronic Design 1

Module Title:	Microelectronic Design 1
Language of Instruction:	English

Credits:	10

NFQ Level:	8

Module Delivered In	2 programme(s)

Teaching & Learning Strategies:	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.

Module Aim:	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.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
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.

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is recommended before enrolment in this module.*
No recommendations listed
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.*
Students should have completed a module equivalent to the following from CW527: Analysis of Analogue Circuits (yr3).

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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

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Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
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	Bachelor of Engineering (Honours) in Biomedical Electronics	7	Mandatory
CW_EESYS_B	Bachelor of Engineering (Honours) in Electronic Engineering	7	Mandatory