TRON H4616: Microelectronic Design

Module Title:	Microelectronic Design
Language of Instruction:	English

Credits:	10

NFQ Level:	8

Module Delivered In	No Programmes

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 student's solutions.

Module Aim:	To provide: Detailed analyses of semiconductor devices and their CAD models; Knowledge of circuit-level simulation tools; Methodologies for digital and analogue IC analysis and design.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Derive and utilise semiconductor device models in circuit design simulations.
LO2	Layout and verify integrated circuit designs.
LO3	Design and analyse analogue IC building blocks such as current mirrors and differential amplifiers.
LO4	Design and analyse static and dynamic CMOS gates at a transistor level.

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).

TRON H4616: Microelectronic Design

Module Content & Assessment

Indicative Content
1. Circuit Simulation SPICE Device Elements; Semiconductor Devices; Analysis Modes and Techniques; Convergence Issues.
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 Configuration.
4. Cascode Stages and Current Mirrors MOS and bipolar Current Mirroring; Cascode Configurations; Temperature and Sensitivity Analysis; Voltage and Current Referencing.
5. Differential Amplifiers Qualitative Analysis and Bipolar/MOSFET Differences; Small-Signal and Large-Signal Analysis; Cascode Differential Amplifiers; Common-Mode Rejection; Use of Active Loads.
6. Frequency Response High-Frequency Device Modelling; Frequency Response of CE and CS Stages; Frequency Response of CC and CD Stages; Frequency Response of Cascode and Differential Stages.
7. Feedback Properties of Negative Feedback; Feedback Topologies; Effect of Non-ideal I/O Impedances; Stability in Feedback Systems.
9. Digital CMOS Cells Dynamic and Static Characterisation of Gates; CMOS Inverter; Static CMOS Logic Design; Power and Delay Considerations; Static Sequential Cell Design.
8. Mixed Signal Circuits ADC and DAC Circuits; Switched-Capacitor Comparator; PLLs.

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 series of written examinations during the module.	1,2,3	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	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	60.00	End-of-Semester

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

TRON H4616: Microelectronic Design

Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
Lecture	Every Week	2.00
Laboratory	Every Week	2.00
Tutorial	Every Week	1.00
Estimated Learner Hours	Every Week	2.00
	Total Hours	7.00