



澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU

Major Programme:	Master of Science in Microelectronics & Master of Philosophy in Microelectronics														
Course Type:	<input type="checkbox"/> CM – Compulsory Major <input type="checkbox"/> L&S – Languages and Skills <input type="checkbox"/> * GE – General Education <input type="checkbox"/> MI – Minor <input checked="" type="checkbox"/> RE – Required Elective <input type="checkbox"/> CPE – Community and Peer Education <input type="checkbox"/> FE – Free Elective														
Course Title: (in Chinese and English)	Interface microelectronic circuits and sensors design 介面接口微電子電路和傳感器設計				Suggested Year of Study:			Year 1							
Duration:	<input checked="" type="checkbox"/> Semester Course <input type="checkbox"/> Yearly Course				Credit Units:			3							
Grading System:	<input checked="" type="checkbox"/> Letter Grade <input type="checkbox"/> P/NP				Pre-requisite: (if any)			None							
Medium of Instruction:	English														
Course Description:	<p>The sensors and their interfaces with the circuits are important parts of electronic devices. They capture vital information from the real world. This course covers the design of sensors and interfacing circuits in the CMOS process. The student will learn to design the sensors for different sensing purposes and their front-end interfaces to process the acquired signals at both system- and circuit-level. Different design considerations will be discussed, such as noise, power consumption, distortion/nonlinearity. Fabrication of the micro-electro-mechanical systems and their integration with the CMOS integrated circuits will also be covered.</p>														
Intended Learning Outcomes (ILO):	<ul style="list-style-type: none"> • Design fundamental building blocks in the CMOS process for signal readout and sensing system. • Implement different sensing elements (thermal, capacitive, resistive, etc.) in the CMOS process and discover their potential applications. • Simulate the sensing circuits and systems in CMOS process using simulation tools and realize their limitations. 														
Major Assessment Methods:	Case Study	Role Playing	Student Presentation	Individual project / paper	Group project / paper	Group discussions	Writing Assignment	Exercises & problems	Service learning	Internship	Field study	Company visits	Reading & Writing Assessments / tests	Listening & Oral Assessments / tests	Others (please specify)
Class Participation / Discussion _____%															
Assignment(s) _____ 60 _____%				√				√							
Test(s) _____%															
Examination _____%															
Others: Project _____ 40 _____%			√		√										
Course Content: (topic outline)	<ul style="list-style-type: none"> - Introduction: basic concepts of CMOS technology such as the structure, different active/passive elements, small-signal model, frequency response and noise model of the elements. - Building fundamental blocks: common configuration of basic CMOS amplifier, filter, voltage/current reference, data-converter, mixer, operational amplifier, chopper amplifier. - Sensing in CMOS process: intrinsic sensing elements (Hall sensors, temperature sensors, etc.) in the CMOS process for different sensing functions, device modeling. - Micro-Electro-Mechanical Systems (MEMS): MEMS fabrication, sensing with MEMS, CMOS-MEMS integration and packaging. - Interfacing the sensors and circuits for signal conditioning: instrumentation amplifier, Wheatstone bridge, oscillators, loading effect, distortion analysis. - Practical labs: learn to use EDA tools (Cadence) and FEM software (ANSYS) to aid the design of the sensing systems. - Case study: review state-of-the-art CMOS sensing systems from recent literature. 														