



澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU

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| 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 part of the electronic devices. They capture vital information from the real world. This course covers the design of sensors and interfacing circuits in 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 such as noise, power consumption, distortion/nonlinearity will be discussed. 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"> • To build fundamental blocks in the CMOS process for signal readout. • To design sensing systems in CMOS process. • To realize different sensing elements (thermal, capacitive, magnetic, optical, etc.) in the CMOS process and their potential applications. • To understand how to interface between the sensing elements and the readout circuits. • To understand the Micro-Electro-Mechanical Systems (MEMS) and the synergy between MEMS and CMOS process. • To use the simulation tools to design the sensing circuits and systems in CMOS process along with an understanding of their limitations. • To present and communicate technical ideas and concepts effectively among different fields. | | | | | | | | | | | | | | |
| 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) | | | | √ | | | | √ | | | | | | | |
| Test(s) | | | | | | | | √ | | | | | | | |
| Examination | | | | | | | | | | | | | | | |
| Others: Project | | | √ | | √ | | | | | | | | | | |
| 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. | | | | | | | | | | | | | | |