澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU

Major Programme:	Master of Science in Microelectronics & Master of Philosophy in Microelectronics		
Course Type:	☐ CM – Compulsory Major ☑ RE – Required Elective ☐ L&S – Languages and Skills ☐ CPE – Community and Peer Education ☐ * GE – General Education ☐ MI – Minor ☐ FE – Free Elective		
Course Title: (in Chinese and English)	High-Frequency and High-Speed Wireless/Wireline Integrated Circuit 高頻高速無線/有線集成電路	Suggested Year of Study:	Year 1
Duration:	☑ Semester Course ☐ Yearly Course	Credit Units:	3
Grading System:	☑ Letter Grade ☐ P/NP	Pre-requisite: (if any)	None
Medium of Instruction:	English		
Course Description:	This is an introductory course in the high-frequency and high-speed systems and circuits of both wireless and wireline tailored for ECE students. It covers topics from basic circuit techniques in the data path of both wireless and wireline, such as a low-noise amplifier, mixer, linear equalizer, non-linear equalizer, automatic gain control amplifier, clock and data recovery circuit, to basic circuit techniques in the clock path, for example, PLL, VCO and divider. Also, we brief more recent techniques, such as non-contact communication and RF+BB communication, with special attention to hardware aspects and wireline applications. The course aims to offer students a set of modern wideband system and circuit solutions and the basic ideas and intuition behind them, emphasizing hands-on experience through practical examples such as high-frequency and high-speed circuit implementation and case studies with Cadence/MATLAB.		
Intended Learning Outcomes (ILO):	This course enables students to have: ・Apply the essential knowledge of high-frequency and high-speed systems and circuits in both wireless and wireline designs. ・Identify the common wireless/wireline circuit building blocks with practical considerations in the data and clock paths. ・Design and simulate high-frequency and high-speed circuits using industrial simulation tools with real-world CMOS processes.		

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 30 %								√							
Assignment(s) 30 %								√							
Test(s) _____ %															
Examination _____ %															
Others *(please specify)* Project 40 %			√	√											

Course Content: (topic outline)	- Introduction: basic concepts, future trends, examples and applications, hardware for high-frequency and high-speed systems and circuit of both wireless and wireline. - Preliminaries: CMOS analog circuit, radio-frequency system and circuit, communication principle, circuit analysis. - Circuit techniques in the data path (wireless): analog baseband, mixer, low-noise amplifier, power amplifier. - Circuit techniques in the data path (wireline): linear equalizer, non-linear equalizer, automatic gain control amplifier, clock and data recovery circuit, multiplexer and de-multiplexer. - Circuit techniques in the clock path (wireless and wireline): phase-locked loop, divider, voltage-controlled oscillator. - Practical labs: basic analysis and verification based on circuit simulation and one project involving the above circuit technique.