Course Information	
Course title	Bioelectronics Circuit Design
Semester	110-1
Designated for	COLLEGE OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE GRADUATE INSTITUTE OF ELECTRICAL ENGINEERING
Instructor	JUN-CHAU CHIEN
Curriculum Number	EEE5058
Curriculum Identity Number	943 U0600
Credits	3.0
Course Syllabus	
Please respect the intellectual property rights of others and do not copy any of the course information without permission	
Course Description	This course covers essential topics for electronics in bioinstrumentation, biomedical devices, and biosensors.
Course Objective	The students will learn (1) the signal transduction mechanisms in different types of biosensors, (2) understand how to define system specifications based on sensor requirements including dynamic range, noise analysis, linearity, power consumption, and (3) design complete signal conditioning circuits with various low-noise and low-power circuit techniques such as current re-use, correlated-double-sampling (CD), and chopping stabilization. Topics include biopotential measurements of ECG and/or neural action potentials, current readout interface circuits for electrochemical and optical sensors, charged-based readout using FET-transistors, magnetic sensors, and emerging topics in powering, wireless communication, microfluidics, electrochemistry, DNA-based sensor, COVID-19 detection, and etc. We will cover gm/Id design methodology for the amplifiers, CMOS chip layout techniques, fundamental of analog-to-digital converters (ADC), successive-approximation register (SAR) ADC, high-resolution oversampling ADC, and various simulation techniques.
References	參考書目: 1. Gray, Hurst, Lewis, Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition, John Wiley & Sons, 2009. 2. B. Razavi, Design of Analog CMOS Integrated Circuits, 1st Edition, McGraw Hill, 2001. 3. Carusone, Johns, Martin, Analog Integrated Circuit Design, 2nd Edition,

	John Wiley & Sons, 2012. 4. Pavan, Schreier and, Temes, Understanding delta-sigma data converters, 2nd Edition, Wiley, 2017. 5. Various materials to be distributed throughout the course.

Progress		
Week	Date	Topic
Week 1	9/27	Course introduction
Week 2	10/4	Signal conditioning and biopotential physiology.
Week 3	10/11	Holiday
Week 4	10/18	Amplifier design, feedback review
Week 5	10/25	Noise analysis and low-noise techniques
Week 6	11/01	ADC fundamentals and SAR-ADC introduction and design
Week 7	11/08	Oversampling concepts and Delta-Sigma modulator introduction
Week 8	11/15	Midterm
Week 9	11/22	Introduction of affinity biosensor
Week 10	11/29	Electrochemistry, current interface circuits, and charge-based readout circuits
Week 11	12/06	Optical sensing and magnetic sensing
Week 12	12/13	Oscillator-based sensors
Week 13	12/20	Microfluidics
Week 14	12/27	Energy harvesting and power management design
Week 15	1/03	Wireless communication for bioelectronics
Week 16	1/10	Final