City University of Hong Kong
Course Syllabus

offered by Department of Electrical Engineering
with effect from Semester A in 2024/2025

Part I Course Overview

Course Title:	Topics in Radio Frequency Circuit Design and Applications
Course Code:	EE6601
Course Duration:	One Semester (13 weeks)
Credit Units:	3
Level:	P6
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	EE4106 Radio Frequency and Microwave Techniques or EE4107 Foundations for Microwave Solid State Circuits, or electromagnetics related courses.
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course aims to provide students with the fundamental of RF circuit design, together with design concept for various applications.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Understand basic concepts of RF circuitry.		✓	✓	
2.	Capability for key RF components design		✓	✓	
3.	Understand various RF systems for different applications		✓	✓	
4.	Experimental skills for RF technology		✓	✓	✓
		100%			

A1: *Attitude*
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: *Ability*
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: *Accomplishments*
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Learning and Teaching Activities (LTAs)

(LTAs designed to facilitate students' achievement of the CILOs.)

LTA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
Lecture	Explain key concepts in radio frequency circuit design and applications	✓	✓	✓	✓			3 hrs/wk (*Some of the lectures in the form of tutorials will be conducted in the laboratory. Nominally 12 hours are laboratory sessions)*
Tutorial	Explain key concepts in radio frequency circuit design and applications	✓	✓	✓	✓			
Mini-project	Conduct projects on radio frequency circuit design and applications	✓	✓	✓	✓			

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.						Weighting	Remarks
	1	2	3	4				
Continuous Assessment: 50%								
Tests (min.: 2)	✓	✓	✓	✓			30%	
# Assignments (min.: 3)	✓	✓	✓	✓			20%	
Examination: 50% (duration: 2hrs , if applicable)								
Examination	✓	✓	✓				50%	
							100%	

Remark:

To pass the course, students are required to achieve at least 30% in course work and 30% in the examination.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Examination	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal level
2. Coursework	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal level

Applicable to students admitted in Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B,)	Marginal (B-, C+, C)	Failure (F)
1. Examination	Achievements in CILOs	High	Medium	Low	Not even reaching marginal level
2. Coursework	Achievements in CILOs	High	Medium	Low	Not even reaching marginal level

6. Constructive Alignment with Programme Outcomes

PILO	How the course contribute to the specific PILO(s)
1	The student will acquire an ability to describe current and anticipated trends in RF circuit design through an overview of the field as well as an in depth understanding of selected topics through lectures, tutorials, assignments and mini-projects.
2	The student will be able to evaluate and analyze new technologies in RF circuit through an understanding of the performance and current industrial applications through lectures, tutorials, assignments and mini-projects.
3	The student will be able to apply related course knowledge in the mini-projects.
4	The student will be able to assess, evaluate and formulate solutions to problems or specifications in RF circuit through theoretical and practical knowledge learnt from lectures, tutorials, assignments and mini-projects.

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

Review of basic RF/microwave theory and techniques
Transmission line theory, s-parameters, passive components, low noise amplifiers, amplifiers, power amplifiers and oscillators. RF transceiver topologies, wireless communications and standards

Modern transistor technology
BJTs, FETs, Si, Ge, SiC, GaAs, InP and GaN.

Advanced amplifier design
Power amplifiers, principles of high efficiency power amplifiers, different modes of operation, different topologies such as Doherty and Chireix.
Applications in wireless systems
RFID, NFC, Bluetooth, WiFi, wireless power transmission.

Radio frequency integrated circuit and MMIC
Technology and key components in integrated circuits/MMIC, basic RF circuits, and system on modern semiconductor substrates, trends and challenges.

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Lecture notes

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	David Pozar: Microwave Engineering, (Addison Wesley, New York, 2nd Edition, 1990)
2.	Tianjia Sun, Xiang Xie, and Zhihua Wang: Wireless Power Transfer for Medical Microsystems, (New York, NY : Springer New York : Imprint: Springer, 2013)
3.	Alison R. McAdams: Radio frequency identification, (New York: Nova Science Publishers, c2011)
4.	Javier Lopez and Jianying Zhou: Wireless sensor network security, (Amsterdam; Washington, D.C. IOS Press, c2008)
5.	Boris A. Atayants: Precision FMCW short-range radar for industrial applications, (Boston: Artech House, c2014)
6.	Caverly, Robert: CMOS RFIC design principles, (London: Artech House, c2007)
7.	Andrei Grebennikov: RF and microwave power amplifier design, (New York : McGraw-Hill, c2005)
8.	Reinhold Lidwig and Pavel Bretchiko: RF Circuit Design - Theory and Applications, (Prentice Hall, New Jersey, 2000)
9.	T C Edwards and M Steer: Foundations of Interconnect and Microstrip Design, (John Wiley, New York, 3rd Edition, 2000)
10.	Mathew M Radmanesh: Radio Frequency and Microwave Electronics, (Prentice Hall, 2001)
11.	Robert S Elliott: An Introduction to Guided Waves and Microwave Circuits, (Prentice Hall, New York, 1993)
12.	K Chang: RF and Wireless Systems, (John Wiley, New York, 2000)
13.	W A Davis and K K Agarwal: Radio Frequency Circuit Design, (John Wiley, New York, 2001)