City University of Hong Kong
Course Syllabus

offered by Department of Electronic Engineering
with effect from Semester A in 2015/2016

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.	10%	✓	✓	
2.	Capability for key RF components design	20%	✓	✓	
3.	Understand various RF systems for different applications	30%	✓	✓	
4.	Experimental skills for RF technology	40%	✓	✓	✓
		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 self-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. Teaching and Learning Activities (TLAs)

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

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
Lecture, tutorial	Explain key concepts in radio frequency circuit design and applications	✓	✓	✓				3 hrs/wk (3 hrs Lect*) **Some of the lectures in the form of tutorials will be conducted in the laboratory. Nominally 12 hours are laboratory sessions.*
Lecture, tutorial, 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%								
Assignments, Test, Tutorial, quiz	✓	✓	✓				10%	
Project	✓	✓	✓	✓			40%	
Examination: 50% (duration: 2hrs , if applicable)								
							100%	

Remark:

To pass the course, students are required to achieve at least 35% in course work and 35% in the examination.

5. Assessment Rubrics

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

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

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
Microwave network parameters, basics of active devices, transmission line theory, passive and active RF components, RF transceiver infrastructure, wireless communications and standards

Wireless power transmission
Basic structure and theory, transformer, mutual inductance, design of RF oscillator, design of rectifier, rechargeable battery and charging circuit.

Advanced high efficiency power amplifier
Analysis of power, efficiency and linearity, transistor technologies of BJT, LDMOS, MESFET, HBT, SiC and GaN MOSFET, modulation systems in wireless communications, and review of class-ABCDEFGH, Doherty, Chireix outphasing power amplifiers.

Radio frequency identification (RFID)
RFID basic and standards, tags, readers, miniaturization, near field communication (NFC).

Wireless network for sensors
Sensor basic and circuit, sensor technology for different application, and wireless connectivity.

Radio frequency integrated circuit
Integrated circuit technology, key components in IC, basic RF circuits, and system on GaAs and CMOS, difference between hybrid circuits an integrated circuits, 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)