City University of Hong Kong
Course Syllabus

offered by Department of Electronic Engineering
with effect from Semester B in 2017/2018

Part I Course Overview

Course Title:	Fundamentals of Radio Frequency (RF) Circuit Engineering
Course Code:	EE5425
Course Duration:	One Semester (13 weeks)
Credit Units:	3
Level:	P5
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	EE3109 Applied Electromagnetics and EE3110 Analogue Electronics; or equivalent
Equivalent Courses: *(Course Code and Title)*	EE6425 Fundamental of Radio Frequency (RF) Circuit Engineering
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course aims to provide students with essential circuit design and measurement techniques in wireless communication devices and radio frequency 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.	Recognize basic RF and wireless circuits.		✓		
2.	Apply S-parameters, transmission line theory and Smith chart for impedance matching.		✓	✓	
3.	Measure RF circuits using Network Analyzer and Spectrum Analyzer.		✓	✓	
4.	Design small signal RF amplifiers using gain circles.		✓	✓	
5.	Simulate RF amplifiers using CAD tools, fabricate, and measure their performances.		✓	✓	✓
		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	5		
Lecture/tutorial	Theory and basic concepts to be taught in a lecture style and reinforced with problem solving and interactive questioning.	✓	✓	✓	✓			3 hrs/wk *for 8 weeks*
Laboratory	Measurements of an RF/microwave circuit using Network Analyzer. To demonstrate effects at RF/microwave frequencies.		✓			✓		3 hrs/wk *for 1 weeks*
Mini-project	CAD of an RF/microwave amplifier, its manufacture and measurement. Reinforce theory through practice.		✓			✓		3 hrs/wk *for 4 weeks*

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	5			
Continuous Assessment: 60%								
At least 3 assignments (mini-projects and laboratory work etc.)		✓	✓	✓	✓		60%	
Examination: 40% (duration: 2hrs)								
							100%	

Remark:

To pass the course, students are required to achieve at least 30% in course work and 30% in the examination. Also, 75% laboratory attendance rate must be obtained.

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-)	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

6. Constructive Alignment with Programme Outcomes

PILO	How the course contribute to the specific PILO(s)
1	The course provides students with general knowledge about microwave and wireless communications.
2,3	Students are required to do an impedance matching exercise that will allow them to put theory into practice.
4	Students will be required to do a mini-project that will require them to assess and evaluate a solution to an RF amplifier design problem.
5	In the same mini-project, students will be required to simulate, design, fabricate, and measure their solution for an RF amplifier.

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

1. Keyword Syllabus

Introduction to Radio Frequency (RF) Engineering
Review of fundamental issues of RF engineering
Key existing applications
Issues related to industry

Basic Skill for RF Engineering
S-parameters and Y-parameters
Impedance and admittance Smith chart
Models of various passive elements such as resistor, capacitor, inductor, via, ..
Bipolar junction transistor and field effect transistor models
Classic ell and single stub impedance matching networks

Classic Design of Small Signal RF Amplifier
Biasing and stabilization circuits
General purpose amplifier design using unilateral transducer gain circles
Low noise amplifier design using available gain circles
Amplifier design using power gain circles

Experimental Skills
Amplifier design using CAD tools
Amplifier realization in laboratory
Circuit tuning
Measurement skill including uses of vector network analyzer and spectrum analyzer

Teaching Methods:
Teaching will be conducted in 3-hour sessions, which are in the form of combined lecture, tutorial, and laboratory sessions. The laboratory support shall consist of four 3-hour sessions on topics of RF circuitry.

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	Guillermo Gonzalez: Microwave Transistor Amplifiers: Analysis and Design, (2nd Edition, Prentice Hall, 1997)

2.2 Additional Readings

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

1.	T. C. Edwards: Foundations for Microstrip Circuit Design, (Wiley, 2016)
2.	George D. Vendelin: Microwave Circuit Design Using Linear and Nonlinear Techniques, (Wiley 2005).
3.	W. K. Chen: Broadband Matching - Theory and Implementations, (World Scientific, 1988)
4.	T. T. Ha: Solid-State Microwave Amplifier Design, (John Wiley & Sons 1981)