

课程大纲

COURSE SYLLABUS

1.	课程代码/名称 Course Code/Title	高阶微波电路与系统设计 Advanced Microwave Circuit and System
2.	课程性质 Compulsory/Elective	专业选修课 Major Elective Courses
3.	开课单位 Offering Dept.	深港微电子学院 School of Microelectronic
4.	课程学分/学时 Course Credit/Hours	3/64
5.	授课语言 Teaching Language	英文 English
6.	授课教师 Instructor(s)	方小虎 Fang Xiaohu
7.	开课学期 Semester	秋季 Autumn
8.	是否面向本科生开放 Open to undergraduates or not	是 Yes
9.	先修要求 Pre-requisites	先修要求 Pre-requisites: SME201 集成电路基础 I-模拟电路 或其他模拟电路课程 SME201 Fundamentals of Integrated Circuit I-Analog Circuit or other courses related with Analog Circuit
10.	教学目标 Course Objectives	<p>(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.)</p> <p>研究生: 通过本课程的学习, 使学生能够掌握射频微波电路的基本原理和设计方法 (包括传输线理论, 导波理论, 微带传输线理论, 微波网络分析, 阻抗匹配和调谐, 微波滤波器、耦合器与功分器、微波放大器设计等) 以及微波系统的主要结构和功能 (包括收发机构架、软件无线电等), 能够熟练应用微波电路理论设计高质量的无源和有源电路, 并独立完成高级课程设计项目的仿真和测试;</p> <p>本科生: 通过本课程的学习, 使学生能够理解射频微波技术的基本原理及主要的分析方法 (包括传输线理论, 导波理论, 微带传输线理论, 微波网络分析, 阻抗匹配和调谐, 微波滤波器、耦合器与功分器、微波放大器设计等), 能够应用基本理论设计简单的无源和有源电路, 并独立完成基本课程设计项目的仿真和测试。</p> <p>Postgraduates: By taking this course, the students can grasp the basic principles and analysis methods of the radio-frequency technology (including transmission line theory, waveguides theory, microstrip line theory, network analysis, impedance matching, microwave filters, couples, power dividers, and microwave amplifiers) and advanced Microwave systems (including RF transceivers and software defined radio). They should be able to apply these theories to design high-performance passive and active circuit. Besides, they must complete the design and simulation of advanced microwave circuits independently.</p> <p>Undergraduates: By taking this course, the students should understand the basic principles and analysis methods of the radio-frequency technology, including transmission line theory, waveguides theory, microstrip line theory, network analysis, impedance matching, microwave filters, couples, power dividers, and microwave amplifiers. They should be able to apply these theories to design simple passive and active circuit. Besides, they must complete the design and simulation of basic microwave circuits independently.</p>
11.	教学方法 Teaching Methods	<p>(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.)</p> <p>本课程的教学方法包括: 讲授、提问研讨、课后习题和答疑、课程设计。本课程针对本科生和研究生设立不同的教学目标和考核方式, 但对两者应用相同的教学方法和内容, 不做区分。</p> <p>Teaching Methods: lectures, tutorials, exercises, answers and course design. This course sets different teaching objectives and assessment methods for undergraduates and postgraduates, but the adopted teaching method and contents for them are the</p>

	same.
12. 教学内容 Course Contents (如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.)	
Section 1 绪论 Introduction	课程安排、与其他课程的关系、常见问题、微波的特点、应用、发展简史、课程体系结构 Course arrangement, relationship with other courses, the characteristic, application and development of microwave circuits, course content.
Section 2 传输线理论和波导 Transmission line theory and waveguide	长线与短线、传输线的种类、传输线的基本分析方法、传输线方程和基本参数、传播常数、输入阻抗、反射系数、驻波比、波导 Long and short lines, types of transmission lines, analysis of transmission lines, transmission-line equations, propagation constants, input impedance, reflection coefficient, standing wave ratio, waveguide
Section 3 无耗传输线分析 Lossless transmission line analysis	无耗传输线状态分析、行波、驻波、行驻波; 传输功率、效率、损耗 Lossless transmission line, traveling wave, standing wave and traveling standing wave, transmission power and efficiency, loss
Section 4 阻抗匹配和史密斯圆图 Impedance matching and Smith chart	集总参数匹配、1/4 波长传输线, 介绍史密斯圆图的构造, 电阻圆、电抗圆、导纳圆等 Lump-element matching technique, 1/4 wavelength transmission line, Smith chart, resistance circle, reactance circle, admittance circle, etc
Section 5 微波网络分析 Microwave network analysis	等效传输线、网络的思想、两端口网络、散射矩阵、T 矩阵、Z 矩阵、A 矩阵 Equivalent transmission line, network analysis, two-port network, S matrix, T matrix, Z matrix, A matrix
Section 6 微波无源电路 Microwave Passive Circuits	经典滤波器、功率分配器、定向耦合器 Principle and implementation of classical filter, Power divider, directional coupler
Section 7 微波放大器设计 Microwave amplifier design	微波放大器的增益、稳定性、输出功率、效率、噪声系数、低噪声放大器 Gain, stability, output power and efficiency of microwave amplifier, Noise figure, Low noise amplifier design
Section 8 射频功率放大器 RF power amplifier	功率匹配、导通角分析、偏置网络和匹配网络设计、谐波调谐技术 Power matching, conduction angle analysis, bias network and matching network design, harmonic tuning technology
Section 9 射频收发机系统构架 RF Transceiver	发射机和接收机构架、镜像抑制、零中频接收机、软件无线电 Architecture of RF transmitter and receiver, image rejection, Zero-IF receiver, software defined radio
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13. 课程考核 Course Assessment	
	(① 考核形式 Form of examination; ②. 分数构成 grading policy; ③ 如面向本科生开放, 请注明区分内容。

If the course is open to undergraduates, please indicate the difference.)

考核形式: 考查 Examine

分数构成: 课程设计 Courses design(50%)+平时成绩 Daily performance (50%)

平时成绩包括: Daily performance include:

1、 作业 Task 40%

2、 考勤及互动 Attendance and Class Performance 10%

关于本科生和研究生考核区分: 本课程针对本科生和研究生分别设定了难度不同的课程设计项目, 要求研究生完成相对复杂的有源电路设计, 而本科生在完成相对简单的课程设计后, 在有余力的情况下, 鼓励其挑战难度更高的有源电路课程设计。

Assessment distinction between undergraduate and postgraduate: This course has set up course projects with different complexities for undergraduates and postgraduates. We requires postgraduates to complete an active circuit design with moderate complexity, while the undergraduates are only required to fulfill relatively simple course projects.

14. 教材及其它参考资料

Textbook and Supplementary Readings

1. Pozar, D. M, Microwave Engineering, Fourth Edition. John Wiley & Sons, Inc, USA, 2012

2. R. L, RF Circuit Design: Theory and Applications, Second Edition. 2nd ed. Publishing House of Electronics Industry, USA 2010.

3. S. Cripps, RF Power Amplifiers for Wireless Communications, Second Edition. Norwood, MA, USA: Artech House, 2006.

4. 刘学观, 郭辉萍, 微波技术与天线 (第四版), 西安: 西安电子科技大学出版社, 2016-1-1,