课程大纲
COURSE SYLLABUS

1.	**课程代码/名称** **Course Code/Title**	**非线性电路与系统** **Nonlinear Circuit and System**
2.	**课程性质** **Compulsory/Elective**	专业课
3.	**课程学分/学时** **Course Credit/Hours**	3/48
4.	**授课语言** **Teaching Language**	英语
5.	**授课教师** **Instructor(s)**	主讲教师：沈平 辅助授课教师：刘奂奂
6.	**是否面向本科生开放** **Open to undergraduates or not**	否
7.	**先修要求** **Pre-requisites**	无

8. 教学目标
Course Objectives

This course is intended to introduce to you the theory and application of nonlinear circuit and system. Upon the completion of the course, you should be able to:
1. Familiar with the classic theory of nonlinear circuit and system;
2. Familiar with the classic analysis ofnonlinear circuit and system;
3. Theoretically understand the essence of nonlinear circuit and system;
4. Learn the physical significance of the phenomenon of nonlinear circuit and system.

本课程目标是使学生了解非线性微波电路理论和用途。完成本课程后，学生可以：
1. 了解非线性电路的基本理论；
2. 了解非线性电路的基本解析方法；
3. 用理论解释非线性电路的本质；
4. 了解非线性电路现象的物理意义。

教学方法
Teaching Methods

Lecture
Quiz
Assignment
Report

10. 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	Introduction, fundamental concepts and definition of nonlinear circuit. 1.1 Linear and nonlinear 1.2 Frequency generation 1.3 Nonlinear phenomena 1.4 Power and gain definition 1.5 Stability 非线性电路的介绍和发展。 1.1 线性与非线性

	1.2 频率的产生 1.3 非线性现象 1.4 功率和增益的定义 1.5 稳定性问题
Section 2	Solid state device Modeling for quasistatic analysis. 2.1 Nonlinear device models 2.2 Nonlinear lumped circuit elements and controlled sources 2.3 Numerical and human requirements for device models 2.4 Schottky-Barrier and junction diodes 2.5 FET device 2.6 Thermal modeling 非线性固态器件建模 2.1 非线性固态器件模型 2.2 非线性集总电路元件和受控源 2.3 设备模型的数值和人员要求 2.4 肖特基势垒和结型二极管 2.5 FET 器件 2.6 热模型
Section 3	Harmonic-balance Analysis and Related Methods. 3.1 Harmonic-balance Analysis 3.2 Transformation matrix analysis 3.3 Generalized harmonic balance 非线性微波电路分析法。 3.1 谐波平衡法 3.2 变换矩阵分析法 3.3 广义谐波平衡法
Section 4	Power-series and Volterra-series analysis. 4.1 Power-series analysis 4.2 Volterra-series analysis 非线性电路分析法。 4.1 幂级数分析法 4.2 Volterra 级数分析法
Section 5	Current research on nonlinear microwave circuit. 5.1 Current research on nonlinear microwave circuit 微波非线性电路理论新进展 5.1 微波非线性电路理论新进展
Section 6	Steps of microwave solid state circuit design. 6.1 Diode selection 6.2 DC operating point selection 6.3 Circuit topology 6.4 Optimization 微波固态电路设计步骤 6.1 选管

	6.2 直流工作点选择 6.3 电路拓扑结构 6.4 优化设计
Section 7	Diode mixer. 7.1 Frequency Converter 7.2 Frequency Mixer 7.3 Up-converter 7.4 FET Up-converter 微波混频器 7.1 变频器 7.2 混频器 7.3 上变频器 7.4 FET 类上变频器
Section 8	Amplifier. 8.1Microwave amplifier 8.2 Low Noise Amplifier 8.3 Power Amplifier 8.4 Linearization for microwave power amplifier 8.5 High-efficiency microwave power amplifier 微波放大器 8.1 微波放大器 8.2 微波低噪声放大器 8.3 微波功率放大器 8.4 微波功放线性化技术 8.5 高效率微波功放技术
Section 9	Diode frequency multipliers 9.1 Basic consideration 9.2 Approximate design 9.3 Harmonic balance analysis 9.4 Practice issues 微波频率倍频器 9.1 设计的基本考虑 9.2 近似设计 9.3 谐波平衡分析 9.4 设计中的实际问题
Section 10	Transistor Oscillator 10.1 Classic oscillator theory (Negative resistance oscillation theory) 10.2 Circuit topology 微波振荡器 10.1 基本理论 （负阻振荡理论 ） 10.2 电路拓扑
Section 11	Millimeter-wave (High frequency front terminal) system.

		11.1 Balanced circuit 11.2 Links of components 11.3 Microwave emission system 11.4 Microwave receiver 11.5 Radar system 11.6 Communication system 微波毫米波（高频前端子）系统 11.1 平衡电路 11.2 微波电路部件的直接连接 11.3 微波发射系统 11.4 微波接收机 11.5 雷达系统 11.6 通信系统

11. 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.）

课堂测试（20%）
课后作业（20%）
课程考核 1：理论部分调研报告（30%）
课程考核 2：电路设计报告（30%）

1.Continuous Assessment 1 (CA1): Quiz （20%）
2.Continuous Assessment 2 (CA2): Assignment (20%)
3.Continuous Assessment 3 (CA3): Case Study 1 Theoretical Study Report （30%）
4.Continuous Assessment 4 (CA4): Case Study 2 Circuit Design Report（30%）

12. 教材及其它参考资料
Textbook and Supplementary Readings

TEXTBOOKS

1. F. Giannimi & G. Leuzzi, microwave circuit using nonlinear technique design, John Wiley& Sons, 2004. (TK7876.G53 2004)
2. Stephen A. Maas, Nonlinear Microwave And RF Circuits, 2nd Edition, Artech House, 2003. (TK7876.M284 2003)

REFERENCES

1. F. Giannimi & G. Leuzzi, microwave circuit using nonlinear technique design, John Wiley& Sons, 2004. (TK7876.G53 2004)
2. Stephen A. Maas, Nonlinear Microwave And RF Circuits, 2nd Edition, Artech House, 2003. (TK7876.M284 2003)
3. 吴景棠，非线性电路原理，国防工业出版社，1990.（ISBN：9787118007763）
4. 刘崇新，非线性电路理论及应用，西安交通大学出版社，2007.（ISBN：978-7-5605-2592-1）
5. 高金峰，非线性电路与系统，科学出版社，2005.（ISBN：7-03-014880-0）
6. George D. Vendelin, Anthony M. Pavio & Ulrich L. Rohde 著，雷振亚，谢拥军译，线性与非线性微波电路设计，电子工业出版社，2005. （ISBN：978-0-471-41479-7）
7. Ulrich L. Rohde & David P. Newkirk, RF/Microwave Circuit Design for Wireless Applications-Appendix B, John Wiley & sons, 2000 (ISBN: 0-471-29818-2)