**Application Form For Opening Graduate Courses**

School (Department/Institute)： School of Information Science and Engineering

Course Type: New Open □ Reopen □ Rename **√（**Please tick in □, the same below）

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| Course Name | | Chinese | 微波毫米波测量技术 | | | | | | | | | | |
| English | Microwave and Millimeter Wave Measurement Technology | | | | | | | | | | |
| Course Number | | |  | | | Type of Degree | | | Ph. D | **√** | Master | | **√** |
| Total Credit Hours | | | 48 | In Class Credit Hours | 24 | | Credit | 2 | Practice | 24 | Computer-using Hours | |  |
| Course Type | | | □Public Fundamental □Major Fundamental □Major Compulsory **√**Major Elective | | | | | | | | | | |
| School (Department) | | | School of Information Science and Engineering | | | Term | | Spring | | | | | |
| Examination | | | A. □Paper（□ Open-book □ Closed-book） B. □Oral  C. □Paper-oral Combination D. **√**Others Experiment design and measurement report | | | | | | | | | | |
| Chief  Lecturer | Name | | Jianfeng Zhai | | | Professional Title | | Lecturer(Ph. D) | | | | | |
| E-mail | | jfzhai@emfield.org | | | Website | |  | | | | | |
| Teaching Language used in Course | | | Chinese | | | Teaching Material Website | |  | | | | | |
| Applicable Range of Discipline | | | second-class discipline | | | | | Name of First-Class Discipline | | Electronic Science And Technology | | | |
| Number of Experiment | | | 6 | | | Preliminary Courses | | Microwave techniques | | | | | |
| Teaching Books | | | Textbook Title | | | Author | | Publisher | | Year of Publication | | Edition Number | |
| Main Textbook | | |  | | |  | |  | |  | |  | |
| Main Reference Books | | | Microwave techniques and experiments | | | Peng Peifu, etc | | Tsinghua University press | | 2007.11 | | 1 | |
| The measurement techniques of modern microwave and antenna | | | Dai Qing, etc | | Publishing house of electronics industry | | 2008.7 | | 1 | |
| The modern electronic measurement techniques- | | | Li Ligong,etc | | National defense industry press | | 2008.7 | | 2 | |

1. **Course Introduction (including teaching goals and requirements) within 300 words:**

Now most postgraduate students have no chance to get systematical learning of microwave and millimeter wave measurement technology and using of microwave instruments in experiment. Hence, the course of Microwave and Millimeter Wave Measurement Technology is applied in spring term, 2011, and it will lay a good foundation for postgraduate students of microwave area in their research.

It is not only a major course for postgraduate students, who major in electromagnetic and microwave techniques, but also an elective course for postgraduate students, who major in communications and circuits and system.

After learning this course, students should master the main parameters of microwave and millimeter wave circuits and system, such as signal characteristics, spectrum, network parameters, measurement principal and methods of parameters in transmitters and receivers. It will lay a necessary foundation for students in microwave and RF circuits learning. For students, majored in information and communication, it will supply necessary basic knowledge in learning measurement techniques of microwave and RF system. The course can not only guide students' interest, but also give a chance to combine theory with practice, and improve the ability to analyze and solve problems in experiment.

1. **Teaching Syllabus (including the content of chapters and sections. A sheet can be attached):**

Chapter 1: The structure and basic concepts of microwave and millimeter wave systems

1. The structure of microwave and millimeter wave systems

2. The classification and development of microwave and millimeter wave measurement instruments

3. Introduction of parameters and measurement of microwave and millimeter wave device, such as filter, attenuator, power divider, coupler, amplifier, oscillator, mixer, antenna, etc.

Chapter 2: The basic theory and use of signal generator

1. The classification of microwave signal generator

2. The principle, structure and feature of vector signal generator

3. The use of vector signal generator

Chapter 3: The basic theory and use of signal analyzer

1. The principle, structure and feature of spectrum analyzer

2. The principle, structure and feature of vector signal analyzer

3. The use of vector signal analyzer

Chapter 4: The basic theory and use of network analyzer

1. The principle, structure of network analyzer

2. The calibration of network analyzer

3. The typical device measurement by network analyzer: filter, power divider, coupler, amplifier.

Chapter 5: The basic theory and application of antenna

1. The basic theory and design of antenna
2. The measurement of antenna in anechoic chamber

Chapter 6: The measurement of phase noise

1. The measurement theory of phase noise
2. The real measurement technology of phase noise

Chapter 7: The professional application of vector network analyzer

1. The introduction of the professional application of vector network analyzer
2. The time domain measurement technology of vector network analyzer

Chapter 8: Logic analyzer and automatic control of instruments

1. The basic theory and measurement of logic analyzer
2. The automatic control of instruments

Experiment 1. The measurement of passive devices by network analyzer

1. The understanding of microwave measurement system, and its principle

2. Master the calibration and measurement procedure of network analyzer

3. The measurement and analysis of filter, power divider and coupler without calibration

4. The measurement and analysis of filter, power divider and coupler with calibration

Experiment 2. The basic measurement of microwave and millimeter wave signal generator and analyzer

1. The basic theory of microwave and millimeter wave signal generator and analyzer
2. The basic use of microwave and millimeter wave signal generator and analyze

Experiment 3. The measurement of active devices by network analyzer

1. The S parameter measurement and analysis of amplifier by network analyzer

2. The nonlinear measurement and analysis of amplifier by network analyzer

Experiment 4. Download modulated signals in microwave and millimeter wave signal generator

1. Download modulated signals in microwave signal generator with WinIQSim software.

2. Download modulated signals in microwave signal generator with Matlab software.

Experiment 5. The analysis of microwave amplifier with vector signals

1. The measurement and analysis of amplifier with single and two tone input by signal generator and analyzer

2. The measurement and analysis of amplifier with IQ modulated signal input by signal generator and analyzer

Experiment 6. The measurement of modulated signals with microwave and millimeter wave signal analyzer

1. The familiarity with the modulated signals of the microwave signal analyzer
2. The measurement and analysis of modulated signals

Experiment 7. The measurement of microwave and millimeter wave antenna

1. The introduction and visit of microwave Anechoic Chamber

2. The measurement and analysis of antenna

Experiment 8. Check and accept

1. **Teaching Schedule:**

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| --- | --- | --- |
| Week | Course Content | Teaching Method |
| 1 | The structure and basic concepts of microwave systems | lecture |
| 2 | The basic theory and use of signal generator | lecture |
| 3 | The basic theory and use of signal analyzer | lecture |
| 4 | The basic theory and use of network analyzer | lecture |
| 5 | The basic theory and application of antenna | lecture |
| 6 | The measurement of phase noise | lecture |
| 7 | The professional application of vector network analyzer | lecture |
| 8 | Logic analyzer and automatic control of instruments | lecture |
| 9 | Experiment 1. The measurement of passive devices by network analyzer | practice |
| 10 | Experiment 2. The basic measurement of microwave and millimeter wave signal generator and analyzer | practice |
| 11 | Experiment 3. The measurement of active devices by network analyzer | practice |
| 12 | Experiment 4. Download modulated signals in microwave and millimeter wave signal generator | practice |
| 13 | Experiment 5. The analysis of microwave amplifier with vector signals | practice |
| 14 | Experiment 6. The measurement of modulated signals with microwave and millimeter wave signal analyzer | practice |
| 15 | Experiment 7. The measurement of microwave and millimeter wave antenna | practice |
| 16 | Experiment 8. Check and accept | practice |
| 17 |  |  |
| 18 |  |  |

Note: 1.Above one, two, and three items are used as teaching Syllabus in Chinese and announced on the Chinese website of Graduate School. The four and five items are preserved in Graduate School.

2. Course terms: Spring, Autumn, and Spring-Autumn term.

3. The teaching languages for courses: Chinese, English or Chinese-English.

4. Applicable range of discipline: public, first-class discipline, second-class discipline, and third-class discipline.

5. Practice includes: experiment, investigation, research report, etc.

6. Teaching methods: lecture, seminar, practice, etc.

7. Examination for degree courses must be in paper.

8. Teaching material websites are those which have already been announced.

9. Brief introduction of chief lecturer should include: personal information (date of birth, gender, degree achieved, professional title), research direction, teaching and research achievements. (within 100-500 words)

1. **Brief Introduction of Chief lecturer:**

**Jianfeng Zhai**, male, born in Oct.1981, received the B.S. degree in radio engineering from Southeast University in 2004, and recommended for admission to M.S. degree learning in 2004, Ph.D. learning in 2006, and received Ph.D. degree in electromagnetic field and microwave techniques in 2009. His Ph.D. thesis title is “Study on Behavioral Modeling and Linearization of wideband Power Amplifiers”. He is a lecturer of Southeast University.

During the period of Ph.D, his research and participate projects include, the National Science Foundation of China (NSFC) under Grant 60702027 and Grant 60621002, the National High-Tech Project under Grant 2007AA01Z2B4 and the international cooperation of 3.5GHz & 2.5GHz Wimax RF module.

The projects as the person in charge include the sub-project "The design and experimental research of 110~800GHz silicon-based novel passive devices" of National 973 project " The basic research of millimeter and sub-millimeter wave silicon-based integrated circuit and system " under Grant 2010CB327400.

Related Publications and patents:

1. **Zhai Jianfeng**, Zhou Jianyi, Zhang Lei, Zhao Jianing, and Hong Wei. The Dynamic Behavioral Model of RF Power Amplifiers with Modified ANFIS[J]. ***IEEE Trans. on Microwave Theory and Technique***, 2009, 57(1): 27-35.
2. **Zhai Jianfeng**, Zhou Jianyi, Zhang Lei, Zhao Jianing, Hong Wei. Dynamic Behavioral Modeling of Power Amplifiers Using ANFIS-based Hammerstein[J]. ***IEEE Microwave and Wireless Components Letters***, 2008, 18(10): 704-706.
3. **Zhai Jianfeng**, Zhou Jianyi, Zhao Jianing, Zhang Lei, Hong Wei. Behavioral Modeling of RF Power Amplifiers with Time-delay Feed-forward Neural Networks[J]. ***Journal of Southeast University (English Edition)***, March 2008, 24(1): 6-9.
4. **Zhai Jianfeng**, Zhou Jianyi, Zhang Lei, Zhao Jianing, Hong Wei. ANFIS Implementation in FPGA for Power Amplifier Linearization with Digital Predistortion[C]. ***2008 International Conference on Microwave and Millimeter Wave Technology (ICMMT2008)***, Nanjing，China，April 2008，3: 1474-1476.
5. **Zhai Jianfeng**, Xie Ningde, Zhou Jianyi, Zhao Jianing, Zhang Lei, Hong Wei. A Novel Adaptive Baseband Digital Predistortion Technique[J]. ***International Journal of Microwave and Optical Technology*** (ISSN 1553-0396), April 2007, 2(2): 119-123.
6. **Zhai Jianfeng,** Zhou Jianyi, Hong Wei, Zhang Lei. A Real-valued Time-delay Neuro-Fuzzy Model for Power Amplifier with Memory Effects[J]. ***Journal of Microwaves.***(accepted)
7. The power amplifier predistortion method of the ANFIS-based Hammerstein model。The inventors：Zhou Jianyi, **Zhai Jianfeng,** Hong Wei**,** The application No.：200810022631.8；The applicant: Southeast University；the date of application：July 28, 2008.
8. **Lecturer Information (include chief lecturer)**

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| --- | --- | --- | --- | --- |
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| Zhai Jianfeng | 83793276 | zhaijianfeng@seu.edu.cn | State Key Lab of Millimeter Waves,  Southeast University, Sipailou 2, Nanjing | 210096 |
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| Kuai Zhenqi | 83793276 | [kuaizq@seu.edu.cn](https://mail.seu.edu.cn/coremail/XT3/pab/view.jsp?sid=BAweEbggJaFEdcBolqggCoFFlGvOBOZy&totalCount=1&view_no=0&puid=280&gid=) | State Key Lab of Millimeter Waves,  Southeast University, Sipailou 2, Nanjing | 210096 |